ASSIGNMENT

Assignee:

Address : 20, Yoido-Dong, Yongdungpo-Gu, Seoul, Korea

Name : LG electronics

Representative : Cha-Hong KOO

I hereby assign the right to obtain a Patent (Utility Model Registration) on the below invention (device) to the above assignee.

July 2, 1998

Assignor:

(Inventor)

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Name : Sung-Il PARK (sign)

Nationality: a Korean Citizen

NOTE

1. Indication of Case:
2. Title of the Invention : Thin Film Transistor Liquid Crystal Display Device

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Assignor:

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NOTE

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2. Title of the Invention : Thin Film Transistor Liquid Crystal Display Device

양 도 증

양 수 인

주 소 : 서울특별시 영등포구 여의도동 20번지

성 명 : 주식회사 LG전자 대표이사 사장 구 자 홍

다음의 발명(고안)에 관하여 특허(실용신안등록)를 받을 수 있는 권리를 귀하에게 양도합니다.

199 8 년 7 월 2 일

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	성 명	윤 상호
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記		
1. 사건의 표시		
2. 발명(고안)의 명칭		박막 액정 패 개리

* 공동 출원시는 발명자(고안자)당 1매씩 양도증만 추가하여 첨부 바랍니다.

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1998 년 7 월 2 일

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記		
1. 사건의 표시		
2. 발명(고안)의 명칭		박막 액정 표시 장치

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[Translation]

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Title of the Invention : LIQUID CRYSTAL DISPLAY

SPECIFICATION

BRIEF DESCRIPTION OF THE INVENTION DRAWINGS

Fig. 1 shows a layout for a unit pixel of a general thin film transistor-liquid crystal display;

Fig. 2 shows a cross-sectional view bisecting the general TFT-LCD in Fig. 1 along with the line I-I′;

Fig. 3 shows a cross-sectional view bisecting the TFT-LCD in Fig. 1 along with the line II-II′;

Fig. 4 shows a cross-sectional view of a TFT-LCD according to the related art;

Fig. 5 shows a layout for a unit pixel of a thin film transistor-liquid crystal display according to the present invention;

Fig. 6 shows a cross-sectional view bisecting the general TFT-LCD in Fig. 5 along with the line III-III′;

Fig. 7 shows a cross-sectional view bisecting the TFT-LCD in Fig. 5 along with the line IV-IV′; and

Fig. 8 shows a cross-sectional view of a TFT-LCD according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

PURPOSE OF THE INVENTION

BACKGROUND OF THE INVENTION

The present invention relates to a liquid crystal display, more particularly, to a thin film transistor-liquid crystal display, which prevents the degradation of contrast by minimizing the reflection rate of light on a data lines as well as improves an opening ratio.

A liquid crystal display (hereinafter abbreviated LCD) is fabricated to provide a state of an image which lessens fatigue of eyes due to external light reflection and releases

rejection symptoms in an aspect of human engineering. Specifically, LCD which is extended for business or personal usages needs a technique for low-reflection to be used for a variety of external light conditions.

Fig. 1 shows a layout for a unit pixel of a thin film transistor-liquid crystal display(hereinafter abbreviated TFT-LCD), and Fig. 2 shows a cross-sectional view bisecting the general TFT-LCD in Fig. 1 along with the line I-I′, and Fig. 3 shows a cross-sectional view bisecting the TFT-LCD in Fig. 1 along with the line II-II′.

Fig. 4 shows a cross-sectional view of a TFT-LCD according to a related art. TFT-LCD, as shown in Fig. 1 and Fig. 4, comprises a TFT array plate *l* where a TFT and a pixel electrode 30 are arranged, a color filter plate *m* including a black matrix 29, a color shift(which is denoted by R and G), and a common electrode(not shown in the drawing), and liquid crystal 28 filling a space between the substrate *l* and *m*.

As most of LCD manufactures introduce a bottom gated TFT of an invented stagger structure, an LCD according to a related art as an example having the TFT of the invented stagger structure will be explained in the following description.

Referring to Fig. 1 for an LCD according to a related art, a gate line 10 lies horizontally long on a transparent substrate 1 which is a TFT array substrate, while a data line 20, which is insulated from and crosses with the gate line 10 is arranged long perpendicularly to the gate line 10.

Referring to Fig. 1 and Fig. 3, a gate electrode 14 protruding out of the gate line 10 is formed to the direction where the data line 20 is arranged. On the gate line 14, an active layer 12 beneath which a gate-insulating layer 22 is inserted is formed.

In the active layer 12, a channel region (not shown in the drawing) is formed to the corresponding region of the gate electrode 14 while a source and a drain region(not shown in the drawing) are defined at both sides of the channel region.

To the direction where the gate line 10 is arranged, as shown in Fig. 1, formed are a source electrode 16 which is diverged from the data line 20 and connected to the source region of the active layer 12 and a drain electrode 18 connected to the drain region of the active layer 12, respectively.

On the above structure, as shown in Fig. 2 and Fig. 3, a passivation layer 24 where a

contact hole exposing the drain electrode 18 is patterned is formed. And, a pixel electrode 30, which covers the contact hole and is connected to the drain electrode 18, is patterned on the passivation layer 24.

The pixel electrode 30, as shown in Fig. 1, may be overlapped with one stage of the data line 20 to increase an opening ratio wherein the passivation layer 24 of an insulator of which dielectric constant is low is inserted between the data line 20 and the pixel electrode 30.

A numeral '32' denotes a window of the black matrix 29, through which a light passes actually, formed in the color filter substrate m shown in Fig. 5.

In the LCD of the related art, as shown in Fig. 4, a common electrode and the respective color filters (denoted by 'R' and 'G') are formed on the color filter substrate m, and the black matrix 29 is formed between the color filters.

The black matrix 29 is formed of a Cr/CrOx layer or a metal layer formed by sputtering Cr, thereby preventing the leak of light from other regions of the color filters except the window during the irradiation of light.

The black matrix, which is formed by depositing a metal layer by sputtering, has reduced thickness and low electric resistance. Thus, the cost of fabrication the black matrix is expensive.

Having advantage of reducing degradation such as cross-talk owing to low resistance, the black matrix is affected greatly by an external light reflection due to its high reflexibility. Accordingly, Cr/CrOx is widely used for black matrix to reduce such influence. In fact, an effect of low reflexibility is achieved, which is because reflexibility of CrOx is about 3% while that of Cr is 60%.

As mentioned in the above description, opening ratio of the LCD of the related art has a limit to be improved due to its constitution.

Although the LCD of the related art has low reflexibility by using Cr/CrOx as a black matrix during light transmission, contrast, which is the ratio of brightness and darkness of an image, is reduced due to the high reflexibility by the data line.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a liquid crystal display, which improves an opening ratio and lowers the ration of light reflection from a data line.

Additional features and advantages of the invention will be set forth in the description which follows and in part will be apparent from the description, or may be learned by practice of the invention. The objection and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, the present invention includes a color filter substrate on a first transparent substrate including a color filter filtering light and a common electrode, a gate line on a second transparent substrate, a data line crossing with the gate line, the data line insulated from the gate line, a gate electrode at a cross-section between the gate line and the data line, the gate electrode diverging from and protruding out of the gate line, a TFT transistor including a source electrode connected to the data line and a drain electrode separated from the confronting the source electrode, a low-reflective layer covering the data line and the gate electrode, the low-reflective layer blocking a light filtered by a color filter not to leak to the direction which is not a window and reducing reflexibility of the light irradiated on surfaces of the data and gate lines, a passivation layer covering the TFT including the low-reflective layer wherein a contact hole exposing a portion of the drain electrode is formed in the passivation layer, a TFT array substrate on the passivation layer, the TFT array substrate including a pixel electrode connected to the drain electrode through the contact hole, and liquid crystal injected and sealed between the TFT array substrate and the color filter substrate.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 5 shows a layout for a unit pixel of a thin film transistor-liquid crystal display

according to the present invention, Fig. 6 shows a cross-sectional view bisecting the general TFT-LCD in Fig. 5 along with the line III-III′, Fig. 7 shows a cross-sectional view bisecting the TFT-LCD in Fig. 5 along with the line IV-IV′; and Fig. 8 shows a cross-sectional view of a TFT-LCD according to the present invention.

In an LCD according to the present invention, as shown in Fig. 5, a gate line 100 lies horizontally long on a transparent substrate 1′ which is a TFT array substrate 1′, while a data line 200 which is insulated from and crosses with the gate line 100 is arranged long perpendicularly to the gate line 100.

A gate electrode 140 protruding out of the gate line 100 is formed to the direction where the data line 200 is arranged. On the gate line 140, as shown in Fig. 6 and Fig. 7, an active layer 120 beneath which a gate-insulating layer 220 is inserted is formed.

In the active layer 120, a channel region (not shown in the drawing) is formed to the corresponding region of the gate electrode 140 while a source and a drain region (not shown in the drawing) are defined at both sides of the channel region.

To the direction where the gate line 100 is arranged, formed are a source electrode 160 which is diverged from the data line 200 and connected to the source region of the active layer 120 and a drain electrode 180 connected to the drain region of the active layer 120, respectively.

The gate electrode 140 and the data line 200(including the source and drain region) are covered with a low reflective layer 230. a numeral '230′ denotes slash lines in Fig. 5.

On the above structure, as shown in Fig. 6 and Fig. 7, a passivation layer 240 where a contact hole exposing the drain electrode 180 is patterned is formed.

A pixel electrode 300, 300′ and 300′′, which is overlapped with the data line 200 and the gate line 100 partially and connected to the drain electrode 180 by covering the contact hole, is formed and patterned on the passivation layer 240.

In the drawing, the pixel electrode which is at the left of the data line 200 and partially overlapped with thereon is denoted by a numeral 300′, the other pixel electrode overlapped partially with the data line at the right side is denoted by a numeral 300. And, another pixel electrode, which lies at the upper side of the gate line 100 and is overlapped partially with the gate line 100, is denoted by a numeral 300′′, while the

pixel electrode, which lies at the lower side of the gate line 100 and is partially overlapped with the gate line 100 is denoted by the numeral 300.

In the LCD of the present invention, as shown in Fig. 8, a common electrode and the respective color filters (denoted by 'R' and 'G') are formed on the color filter substrate m', but a black matrix is not introduced.

A space between the TFT array substrate l' and the color filter substrate m' of the LCD according to the present invention is filled and sealed with liquid crystal 280.

A method of fabricating a liquid crystal display according to the present invention will be explained in the following description by referring to Fig. 6 and Fig. 7.

A metal layer is formed on a TFT array substrate l' of transparent substrate 1' by depositing metal such as Al, Mo, or the like by sputtering.

A gate line 100 and a gate electrode 140 are formed by patterning the metal layer to remain on a predetermined region.

The gate line and the gate electrode are usually formed of Al for its low electric resistance to reduce RC delay, which is critical in TFT-LCD operation, of the gate line. However, pure Al is vulnerable to chemical in tolerance and cause wire degradation such as hillock and the like during thermal treatment in high temperature process. Therefore, Al alloy or a stacked layer is used instead of pure Al.

On the transparent substrate 1', a gate insulating layer 220 to cover the gate electrode 140, an amorphous silicon layer for a TFT channel, and a silicon layer doped with impurities as an ohmic contact layer for a source/drain electrodes are deposited successively.

Then, an active layer 120 is formed by patterning the amorphous silicon layer and the silicon layer doped with impurities.

In this case, the remaining silicon layer doped with impurities becomes an ohmic contact layer (not shown in drawing). And, the gate-insulating layer 220 is mainly formed of silicon nitride (SiNx).

After a metal layer has been formed on the above structure by depositing metal such as Cr or the like by sputtering, a data line 200 crossing with the gate line 100, a source 160 connected to the source region of the active layer 120, and a drain electrode 180 which is

separated from and confronts the source electrode 160 are formed by patterning the metal layer.

A portion of the silicon layer doped with impurities, as not shown in the drawing, is etched in use of pattern for the source/drain electrodes in order to separate the ohmic contact layer inserted between the active layer 120 and the respective source/drain electrodes 160 and 180 from the source and drain electrodes 160 and 180.

And, a Cr/CrOx layer is formed by forming Cr on the above structure and by carrying out thermal oxidation on Cr.

A low-reflective layer 230 is formed by patterning the Cr/CrOx layer to cover the data line 200 and the gate line 100. The low-reflective layer 230 of the remaining Cr/CrOx lowers reflexibility of a light irradiated on surfaces of the data line 200 and the gate line 100 under 3%.

Then, a passivation layer 240 is formed to cover the above structure by chemical vapor deposition. The passivation layer 240 is formed of one of silicon nitride of which dielectric constant is low and organic insulator such as acryl, BCB(benzocyclobutene), PFCB(perfluorocyclobutane), FPAE(Flouropolyarrylether), cytop and para-xylene.

And, a contact hole exposing the drain electrode 180 is formed by patterning the passivation layer 240 by etch.

After ITO(indium tin oxide) has been deposited on the passivation layer 240, a pixel electrode 300 connected to the drain electrode through the contact hole is formed by pattering the ITO by etch.

Accordingly, the TFT array substrate l' according to the present invention is completed.

A color filter substrate m' of the present invention is constructed with the respective color filters (denoted by R or G) without a black matrix by a general method.

After liquid crystal 280 has been injected between the TFT array substrate l' and the color filter substrate m' where the color filters are fabricated, a LCD of the present invention is completed by sealing the substrates.

The LCD according to the present invention is constructed without a black matrix and with a structure such that a pixel electrode is overlapped partially with the data and gate lines in the TFT array substrate and such that a low-reflective layer covers the data and